

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

In the Matter of)	
)	
LightSquared Technical Working Group Report)	IB Docket No. 11-109
)	
LightSquared License Modification Application,)	IB Docket No. 12-340
IBFS File Nos. SAT-MOD-20120928-00160, -)	
00161, SES-MOD-20121001-00872)	
)	
New LightSquared License Modification)	IB Docket No. 11-109; IB Docket No. 12-340
Applications IBFS File Nos. SES-MOD-20151231-)	
00981, SAT-MOD-20151231-00090, and SAT-)	
MOD-20151231-00091)	
)	
Ligado Amendment to License Modification)	IB Docket No. 11-109
Applications IBFS File Nos. SES-MOD-20151231-)	
00981, SAT-MOD-20151231-00090, and SAT-)	
MOD-20151231-00091)	

**PETITION FOR RECONSIDERATION OF
AIR LINE PILOTS ASSOCIATION, INTERNATIONAL**

Capt. Bob Fox, First Vice President
Air Line Pilots Association, International
1625 Massachusetts Avenue, N.W.
Washington, D.C. 20036
(202) 797-4036

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Pursuant to Section 1.106 of the rules of the Federal Communications Commission (“Commission”), the Air Line Pilots Association, International (“ALPA”) hereby requests that the Commission reconsider its April 22, 2020 Order and Authorization¹ in the above-captioned proceedings granting a license to Ligado Networks, LLC (“Ligado”) to operate an Ancillary Terrestrial Component (“ATC”) in the 1525-1559 MHz and 1626.5-1660.5 MHz bands. ALPA is the largest non-governmental aviation safety organization in the world. ALPA represents the safety interests of more than 63,000 pilots flying for 34 airlines in the United States and Canada and has standing to file this Petition and an interest in the outcome of this matter.²

ALPA is seriously concerned that the Commission did not fully comprehend or appreciate the safety performance levels required to ensure safe operation of GPS aviation communication, navigation and surveillance services, or the threat of adverse operational impacts from Ligado’s proposed service. The tests and evidence relied upon by the Commission were inadequate to rule out failure modes that can result in serious adverse safety consequences resulting from interference with critical GPS-dependent aviation equipment and services.

The Commission’s decision to allow relatively powerful terrestrial transmitters to operate in and adjacent to bands traditionally reserved for satellite navigation and communication services raises important public policy concerns that should have been addressed in an open and

¹ See *LightSquared Request to Modify Its ATC Authorization*, IB Docket Nos. 11-109 and 12-340, Order and Authorization, FCC-20-48 (rel. Apr. 22, 2020) (“Order”).

² ALPA is a labor union and unincorporated association that represents the safety interests of airline pilots. See <http://www.alpa.org>. 47 C.F.R. § 1.106(b)(1) permits a “person whose interests are adversely affected” to petition for the reconsideration of an action taken. ALPA is an interested person because the pilots represented by ALPA use Global Positioning System and satellite communications in the bands adjacent to those licensed by the Order for safety-of-life navigation, surveillance, and communications. The Order will affect the work carried out by ALPA members. Its members will suffer actual injury from services authorized in the Order as they will be placed in a position of increased responsibility and workload, diversion of attention, degraded safety, and increased risk of physical harm.

comprehensive public proceeding with full and fair notice and opportunity for comment rather than in this limited license application proceeding. On the record of this proceeding the risk of harm to aviation and other satellite spectrum users far outweighs any public benefit. The public benefit from repurposing this spectrum for non-satellite 5G use is minimal. The amount of spectrum involved is only very small percentage of that required and expected to be available for 5G and does not form part of the Commission's own 5G plan.³ The national and public interest do not require and do not favor granting Ligado's license request. It was unreasonable and arbitrary for the Commission to fail to properly consider aviation safety standards and to authorize terrestrial transmitters in the bands historically reserved for satellite services. ALPA respectfully requests the Commission to reconsider, reverse and withdraw its Order authorizing Ligado's service.

DISCUSSION

A. ALPA's Members Rely upon GPS, SATCOM, and Other Affected Systems to Safely Operate Airline Transportation Services for the Benefit of the Flying Public

The Commission improperly concluded that interference from Ligado's service would not compromise or harm aviation system users or existing, required GPS, SATCOM and performance guarantees. In doing so, the Commission arbitrarily relied on incomplete and limited testing sponsored by Ligado to conclude that the amended applications at reduced (10W) power levels did not present significant safety or operational threats to those that that rely upon certified aviation GPS receivers. *See* Order at 40. The Commission reached its conclusion even though it was clear that GPS-equipped aircraft operating at low levels and outside obstacle

³ *See, e.g.*, Hearing to Receive Testimony on Department of Defense Spectrum Policy and the Impact of the Federal Communications Commission's Ligado Decision on National Security Before the S. Comm. on Armed Services (May 6, 2020), transcript available at https://www.armed-services.senate.gov/download/20-21_05-06-2020 (*see* Transcript at 27).

clearance zones could be subjected to harmful interference. *See id.* at 39. Garmin, a major manufacturer of certified aviation GPS receivers, expressed concern that the aviation industry's safety issues had not been adequately addressed and that the Commission should work closely with the Federal Aviation Administration ("FAA") to enlarge the inquiry to focus on and exhaustively review those safety-related concerns. *Id.* at 40. Garmin was concerned that any grant of Ligado's applications should be preceded by an explicit FAA determination and acknowledgement that the operation of the proposed network is compatible with certified aviation devices. ALPA agrees.

The Commission acknowledged that the FAA is the "expert agency with a critical interest in ensuring the reliability of certified aviation GPS devices," *id.*, yet the Commission simply overrode the FAA's technical and safety concerns, and the FAA's opposition to Ligado's license applications.⁴ Instead, the Commission relied upon Ligado-sponsored testing results and Ligado's arguments that because any flight within 500 feet of an object requires visual references, then the risk of GPS signal degradation within 250 feet from its towers would not present a safety of flight issue. The Commission further relied upon Ligado's representation that it would keep aviation stakeholders informed of broadcast locations as a mitigating measure. In relying on Ligado's tests and representations and rejecting the views of federal agency and aviation stakeholders including ALPA the Commission subjectively determined that in most cases it was more likely than not that harmful interference would not occur in real world conditions. *See Order* at 40-41.

⁴ *See* Letter from Lawrence E. Strickling, National Telecommunications and Information Admin. ("NTIA"), Dep't of Commerce (Feb. 14, 2012) (filed in IB Docket No. 11-109), <https://www.fcc.gov/ecfs/filing/6016985810>.

Ligado failed to meet its burdens and the Commission's reliance on Ligado's representations and evidence to grant Ligado a license was arbitrary. Ligado's sponsored testing considered only partial parameters under limited circumstances. It considered a limited selection of devices (14 GPS devices, compared to the Department of Transportation's ("DOT") tests of 80 devices) and treated those devices tested as representative of all GPS devices. Ligado's tests focused on performance-based testing and failed to account for many plausible GPS scenarios. The Ligado tests addressed only position and timing functions, not velocity or other GPS outputs that the DOT testing covered in its methodology. Finally, the Ligado-sponsored test plan, and the Commission decision, were flawed as both failed to account for or include even a basic aviation risk assessment.

ALPA requested that the Commission consider and evaluate the risk of harm to its members and the flying public in these proceedings in 2011, 2012 and 2016, jointly in 2018 and again on April 21, 2020. On July 29, 2011, ALPA complained in Docket No. 11-109 of the safety and economic dangers from (then) LightSquared's proposed transmissions "billions" of times stronger than GPS signals.⁵ Even though the modified applications later lowered the proposed output of Ligado's transmitters, Ligado's proposed terrestrial transmitters remain "billions" of times stronger than competing GPS signals. On February 24, 2012, in Docket No. 11-109, ALPA emphasized the "essential" role of GPS in reducing "approach and landing accidents, controlled flight into terrain and runway incursions."⁶ On May 23, 2016, ALPA wrote in Docket Nos. 11-109 and 12-340 emphasizing its "significant concerns" over the lack of

⁵ Letter from Capt. Charles S. Hogeman, Aviation Safety Chair, ALPA (July 29, 2011) (filed in IB Docket No. 11-109), <https://www.fcc.gov/ecfs/6016833708>.

⁶ Letter from Mark Cato, Senior Staff Engineer at 2, ALPA (Feb. 24, 2012) (filed in IB Docket No. 11-109), <https://www.fcc.gov/ecfs/6016995781>.

“quantitative data” on the impact to aircraft navigation systems.⁷ On June 18, 2018, ALPA joined other concerned organizations in a letter to the FAA Administrator stating great concern over Ligado’s statements in these proceedings that because “interference to GPS navigation and GPS-dependent systems” is “limited to a 500-foot diameter around their transmission towers,” the “aviation industry concerns [had] been addressed.”⁸ That letter emphasized the Commission’s lack of a meaningful “understanding” and “thorough assessment” of the “*operational impacts*” based on “[e]mpirical data” using “industry-accepted standards” and stated that additional work was necessary to understand “qualitatively and quantitatively identify [adverse operational] impacts.” (emphasis added). It was incumbent upon the Commission to enlarge the issues to address these operational concerns.

An April 21, 2020 letter in which ALPA joined, submitted in Docket Nos. 11-109 and 12-340, reviewed the history of these proceedings and reflected ALPA’s position and that of other aviation industry stakeholders.⁹ That letter made clear that Ligado’s applications should be denied because these license proceedings had simply “failed to provide answers to many fundamental questions regarding coexistence [of Ligado’s proposed service] with critical aviation safety of flight systems dependent upon GPS.”¹⁰ As we explain below, because the

⁷ Letter from Darrell Pennington, Staff Engineer, ALPA (May 23, 2016) (filed in IB Docket Nos. 11-109 and 12-340), <https://www.fcc.gov/ecfs/6001957520>.

⁸ Letter to Daniel K. Elwell, Acting Administrator, FAA, from Captain Tim Canoll, President, ALPA, et al. (June 15, 2018) (filed in IB Docket Nos. 11-109 and 12-340), <https://www.fcc.gov/ecfs/10618099257402>.

⁹ Letter from Edward A. Yorkgitis, Counsel to Aviation Spectrum Resources, Inc., documenting an April 17, 2020 *ex parte* meeting with FCC Commissioner Michael O’Rielly in which ALPA participated concerning IB Docket Nos. 11-109 and 12-340 (Apr. 21, 2020), <https://www.fcc.gov/ecfs/104220528230559>.

¹⁰ *Id.* at 1. All relevant potential public interest harms should have been properly balanced against any proposed public interest benefits. *See, e.g., In the Matter of Wavecom Solutions Corp.*, 27

Commission failed to address fundamental and outstanding issues related to operational safety of flight its decision was unreasonable, arbitrary, capricious, an abuse of discretion and contrary to law upon the evidence in the record. The Commission should reconsider its decision to grant Ligado's applications without first analyzing or addressing in an appropriate qualitative and quantitative manner the level of operational risks posed to the flying public, as requested by ALPA and other aviation commenters.

In making this request ALPA recognizes the deference traditionally afforded the Commission when it acts to foster “innovative methods of exploiting the spectrum,” and to the Commission's “technical judgments” when supported by a “reasoned analysis.” *NTCH, Inc. v. FCC*, 950 F.3d 871, 879-80 (D.C. Cir. 2020), quoting *MobileRelay Assocs. v. FCC*, 457 F.3d 1, 8 (D.C. Cir. 2006). But the Commission must exercise its “analysis” and discretion in a way that is reasonable and not “arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law.” 5 U.S.C. § 706(2)(A); *Transp. Intelligence, Inc. v. FCC*, 336 F.3d 1058, 1062-64 (D.C. Cir. 2003). Here, the Commission abused its discretion by utilizing an analysis that confounded the risks involved. The Commission's analysis failed to translate its findings on “harmful interference” with aviation receivers, which it defined as a loss or corruption of GPS satellite data during Ligado's testing, into any meaningful or comprehensive consideration of aviation operational safety risks. The operational risk issue was plainly before the Commission upon the record of these proceedings.

ALPA agrees with the views of the federal agencies and other petitioners in opposition that the DOT's tests were more appropriate and that the 1dB C/N₀ standard was the proper

FCC Rcd. 16081, 16084-83 (Dec. 28, 2012); *In the Matter of BCE Inc.*, 22 FCC Rcd. 18049, 18052-54 (Oct. 4, 2007).

measure of harmful interference and should have been relied upon by the Commission in this case. ALPA also agrees with the views of other petitioners in opposition that allowing terrestrial transmissions to intrude into the satellite bands – especially at the 10W power levels authorized in this case – is contrary to the public and national interests and will serve to undermine a globally-recognized frequency-protection standard reserving these frequencies for satellite-only transmission because of the significant likelihood for harm. ALPA also agrees that the Order failed to properly assess the vulnerability of extremely weak satellite transmissions to terrestrial interference. We will not repeat those arguments in detail here but incorporate them by reference and we focus the remainder of our comments on matters of particular concern to ALPA.¹¹

Of particular importance here is that GPS and SATCOM performance must be operationally *guaranteed* in ways and under conditions beyond those examined by the Commission and the Ligado-sponsored testing in order for airline aviation target safety levels to be met. Required GPS and SATCOM performance standards include signal accuracy, integrity, availability, and continuity. Certified aviation GPS receivers and SATCOM equipment in airline operations incorporate protections that help ensure GPS and SATCOM operations meet the target levels of safety at all times. Because this part of the spectrum from 1525-1695 MHz has long been reserved for satellite applications, designers of these systems could not have predicted that terrestrial emitters would occupy adjacent spectrum, and in the case of SATCOM, share the same spectrum used by some satellite transmitters. As is well known, the power levels of the GPS satellites at the receiver are quite weak (approximately -160dBW), while the Ligado base station transmitters will be able to transmit at up to 9.8dBW, a power level many orders of

¹¹ See, e.g., Letter from Douglas W. Kinkoph, NTIA, Dep’t of Commerce (Dec. 6, 2019) (filed in IB Docket Nos. 11-109 and 12-340), <https://www.fcc.gov/ecfs/120643659052>.

magnitude higher than the GPS signals at the GPS receiver. While certified aviation GPS receivers do have some protections against Ligado interference, the Commission did not adequately consider the situations where Ligado interference might affect certified aviation GPS receivers. In addition, the widespread use of non-certified GPS receivers in aviation operations is sufficiently broad to cause safety concerns for ALPA.

Instead of attempting to quantify risk, the Commission arbitrarily concluded that requiring Ligado to place its transmitters outside the regulatory *obstacle* clearance surfaces specified in Part 77 of the FAA’s regulations (Title 14, Code of Federal Regulations) would be an adequate risk mitigation. The Commission’s Order misinterpreted and misapplied FAA safety standards. The Order’s mitigation conclusions appear to be based upon a misunderstanding, or lack of understanding, of aircraft operations. Requiring Ligado to place its transmitters outside of an obstacle clearance zone might make sense if the risk presented was a danger of collision with Ligado’s transmission towers, but it makes much less sense as a true mitigation of the dangers from frequency interference.

FAA policy quantifies airline safety performance for the public benefit at a very high level using a risk management concept.¹² Risk analysis is composed of two separate elements: the *severity* of a hazard, and the *likelihood* of a hazard. For example, the most severe hazard would be an aircraft accident resulting in fatalities and is labeled a *catastrophic* hazard. In ensuring that airline travelers are protected the FAA calculates the probability of a hazard occurring per operation or flight hour (depending on the nature of the hazard).¹³ A *probable*

¹² See, e.g., FAA, *Air Traffic Organization Safety Management System Manual April 2019*, <https://www.faa.gov/air-traffic/publications/media/ATO-SMS-Manual.pdf> (“FAA Safety Manual”).

¹³ The use of “operations” as the metric would be appropriate for those events which occur only at specific instances – for example, an approach to landing at an airport. The use of “flight

hazard is one that occurs more often than 1 time per 100,000 operations or flight hours (i.e., 1×10^{-5}), while an *extremely remote* likelihood is less than 1 time per 1,000,000,000 operations or flight hours (i.e., 1×10^{-9}). The FAA – in compliance with International Civil Aviation Organization (“ICAO”) standards – established policies setting an aviation “target level of safety” that *catastrophic* events occur at a rate *less than 1×10^{-9} per operation or flight hour*.

The Commission quotes Metro Aviation in stating that, “operations within 500 feet of an object require flight by visual reference rather than relying on instruments, including GPS.”¹⁴ However, GPS provides position information to the Terrain Awareness and Warning Systems which are required to be operational *irrespective* of location of the aircraft and regardless of whether visual references are being used. The Order would permit an increase in potential interference with aircraft Terrain Awareness and Warning Systems just when those systems are most needed – when airline pilots are near or beyond the limits of obstacle clearance zones. As those systems provide safety of life protection this result is unacceptable.

Certified aviation GPS receivers must continue to reliably operate at the edge of, below or outside of obstacle clearance zones. Such would be the case when vertical or lateral airline flight path deviations occur during instrument approaches to landing in conditions such as wind shear, turbulent or rough weather, high winds, during emergency situations such as an engine failure on takeoff, or during collision avoidance maneuvers near an airport at a low altitude. In addition, low-level helicopter operations equipped with GPS receivers routinely fly below regulatory obstacle clearance surfaces and may be equipped with Terrain Awareness and

hours” as the metric would be appropriate for items which operate continuously – for example, the uncontained failure of an aircraft engine compressor assembly. Depending on the event being evaluated in a safety case, the required GPS and SATCOM performance may be stated in either metric.

¹⁴ Order ¶ 68, at 39.

Warning Systems. In FAA Advisory Circular 20-138D, failure of the GPS system, either for general navigation or as an input to Terrain Awareness and Warning System, would be considered a Major failure.¹⁵

In order to meet the Target Level of Safety, the GPS system must not fail¹⁶ more often than 1×10^{-5} per hour. In any of the cases mentioned above a proper aviation risk assessment would require accounting for situations where *compromised GPS navigation guidance or a false or missed Terrain Awareness and Warning System alert associated with Ligado's interference would present a severe hazard to safety of flight* such as an increased risk of collision with the ground or another aircraft.¹⁷

This level of diligence and comprehensive risk analysis may seem foreign to those who operate other work environments where turning a profit may be a primary objective. Comprehensive and relentless risk analysis has created and maintains the safest transportation system in human history and ALPA's pilots live it every day. The Commission erred in this case by creating and relying upon an ad hoc standard for harmful interference that did not allow for *any* meaningful quantification of risk. This is an arbitrary and unacceptable way to go about analyzing any threat to the Nation's air transport system.

¹⁵ FAA, Advisory Circular 20-138D, *Airworthiness Approval of Positioning and Navigation Systems* (Apr. 7, 2016).

¹⁶ FAA, Advisory Circular 25.1309-1A, *System Design and Analysis* (June 21, 1988).

¹⁷ The June 15, 2018 letter from Captain Tim Canoll, *supra* note 8, to Acting FAA Administrator Elwell also observed (at 2) that from the perspective of operators that conduct a variety of missions in the low altitude environment, including unmanned operations, often in close proximity to flight obstructions, a loss of navigational accuracy/reliability would produce distractions for operators, unnecessarily increase crew workloads, and could have adverse impacts on the ability to safely navigate. Additionally, within areas of high-density tower deployment, operators could potentially experience repeated loss of GPS.

In requesting reconsideration of this matter ALPA wishes to emphasize that it is important that the Commission recognize just how recently GPS navigation and warning systems have been adopted in the airline world. It was only after the Korean Air Lines disaster in 1983 that the U.S. government decided to make GPS available for civilian use. In 1994 the FAA certified the first aircraft GPS navigation unit for instrument flight. Airlines thereafter began cautiously adopted this new technology. Additional accidents, notably American Airlines 965 in Cali, Columbia in December 1995, drove the need for airliners to also be equipped with Terrain Awareness and Warning Systems using input from GPS. Only within the last 15 years have GPS receivers become ubiquitous in airline cockpits. Until the widespread adoption of GPS receivers in airline cockpits ground-based aviation navigation transmitters remained absolutely necessary, especially to aid and guide airline aircraft to safe landings during restricted visibility or in poor weather. Those ground-based aids also significantly improved operational safety during routine night and daytime operations.

Within the last decade the FAA (in significant part to save scarce government resources) began earnestly decommissioning government-owned ground-based aviation navigation transmitters and radar sites, shifting air navigation, traffic separation, and low-altitude warning functions away from FAA ground air traffic control facilities to ever more critical GPS receivers in airline cockpits. Like mariners of old, today's airline pilots rely upon faint celestial signals to navigate their craft's journey to a safe conclusion. Rather than relying upon starlight the very lives of today's airline pilots and passengers depend, routinely, on very, very faint signals broadcast from GPS satellites twelve or more thousand miles away. Modern technology has made it possible for airliners to reliably navigate and land solely based upon these very faint celestial GPS signals without reference to visual conditions outside the cockpit. But just as stars

can be washed out by light pollution, the GPS satellite signals are so faint compared to terrestrial emissions that *any* interference from terrestrial sources run a high risk of degrading GPS performance with adverse safety consequences. It is for exactly this reason, that the satellite navigation and communication bands are by international standard traditionally considered off-limits to terrestrial transmitters because the risks of harmful interference are too great and any benefit too small.¹⁸

Ligado failed to meet its burden of proof and the Commission failed to address the operational issues raised by aviation petitioners. The Commission's decision to give it a try and see what happens by granting Ligado a license on incomplete evidence strains credulity. The Order's "mitigation" requiring Ligado to provide base station location information to aviation operators and its proposal to have operators identify any problems presents an impossible and unreasonable burden shift to aviation operators, including pilots.¹⁹ Under the Order, airlines and airline pilots will be expected to know and maintain awareness of the locations of potentially thousands of Ligado base stations that may interfere with their navigation. Pilots must continuously monitor and analyze the performance of navigation equipment on an ongoing basis for new threats such as an out of tolerance Ligado transmitter, in all kinds of weather conditions, with the hope of identifying and responding to misleading or erroneous indication before disaster strikes. The Commission's proposed solution is arbitrary, irrational, and unsupported on any logical basis by the record. The best-case scenario under the Order is a higher workload for flight crews, especially in bad weather, and further erosion of safety.

¹⁸ See for example 47 C.F.R. 2.106, *Table of Frequency Allocations*: the entire spectrum band from 1525.0-1668.4 MHz is reserved for satellite and passive uses such as radio astronomy. This did not occur by random chance.

¹⁹ Order ¶ 147, at 68-69.

B. Non-Certified GPS Receivers Used by Non-Airline Operators Present a Hazard If Affected by Ligado Interference

Many General Aviation (“GA”) aircraft do not use certified aviation GPS receivers, or use a combination of certified and uncertified GPS receivers. Just as airline pilots have replaced their paper chart bags with Electronic Flight Bags, GA pilots are using tablet computers with external uncertified GPS receivers of several makes and models, as their source for charts and navigation in the cockpit. While GA pilots in these aircraft should be using additional instruments beyond their tablet GPS for navigation, in practice pilots use GPS as their primary navigation tool with occasional cross-checking with certified instruments or outside visual reference. There are approximately 198,000 GA aircraft registered in the United States,²⁰ and approximately 289,600 active private and commercial GA pilots.²¹

According to the FAA, as of March 10, 2020, there were 1,563,263 Unmanned Aircraft Systems (“UAS”) registered in the United States.²² Most, if not all, of these aircraft, as recognized in the Order,²³ are not equipped with certified aviation GPS receivers, nor are they required by the FAA to be equipped with certified receivers. Further, the only navigation capability that nearly all small UAS have onboard are these uncertified GPS receivers; they do

²⁰ Aircraft Owners and Pilots Association, *2019 State of General Aviation*, http://download.aopa.org/hr/Report_on_General_Aviation_Trends.pdf. The number of GA aircraft registered in the United States is estimated as 90% of 220,000, or about 198,000 aircraft. The exact number of aircraft with certified aviation GPS receivers installed for use for pilot navigation is not known.

²¹ FAA, *U.S. Civil Airmen Statistics*, 2019, https://www.faa.gov/data_research/aviation_data_statistics/civil_airmen_statistics. (last visited May 18, 2020).

²² FAA, *UAS by the Numbers*, https://www.faa.gov/uas/resources/by_the_numbers. (last visited May 18, 2020).

²³ Order ¶ 72, at 41.

not have backup navigation capabilities in the event of a GPS interference event. Smaller UAS may have embedded GPS receivers for which replacement with a new receiver may not be feasible. Given the sheer number of UAS designs, it is not possible to accurately estimate how many of these unreplaceable receivers would be susceptible to Ligado interference. The Commission should assume all UAS operations in the vicinity of the Ligado transmissions will have interference issues.

The hazard presented by GA and UAS using non-certified GPS receivers in these two cases is interference from a Ligado base transmitter that degrades or causes loss of GPS function, which in turn causes the pilot or navigation system of these aircraft to lose awareness of their position, and therefore blunder into the path of another aircraft, including a military or airline aircraft.²⁴ With the Commission's adoption of an interference limit that is right at the edge of experienced harmful interference²⁵ for non-certified receivers, the previous determination of safe system level performance with the use of non-certified GPS receivers becomes difficult to quantify in the presence of Ligado transmissions. The use of a so-called "performance based" metric, where actual degradation of the calculated position must occur before a receiver is considered to have been interfered with, will by its nature be very scenario and receiver dependent. The effect of such interference on the National Airspace System is to reduce safety, but the extent to which it is reduced cannot be determined until after interference is reported. This operational scenario – a wait and see how bad the impact of this experiment will be – is a significant cause for concern from ALPA's perspective. Use of a stronger technical standard for

²⁴ One example of how this might occur is the unintended penetration of GA aircraft into Class B airspace around a busy airport. The rules for Class B airspace exclude all aircraft without an explicit clearance from Air Traffic control. Class B airspace surrounds the busiest 35 commercial airports in the United States. *See* 14 C.F.R. Part 91 App'x D.

²⁵ Order ¶ 47, at 27.

interference, such as the 1 dB C/N₀ proposed by NTIA and other government and private organizations²⁶ would provide much more confidence in the continued safety of aviation. ALPA strongly recommends that the Commission reconsider the interference standard stated in the Order.

Adding to our concern is the fact that there are likely literally millions of existing GPS aviation receivers in use. Thus, while the Commission says that it is possible to build future versions of GPS receivers that might be robust enough to withstand to interference from a Ligado base station transmitter for use in non-certified aviation applications, the Commission does not directly address the harm to millions of existing GPS receivers in aviation use today. Shutting down aviation until a revised safety analysis can be completed and the new risks mitigated is not an acceptable means to address safety concerns that are bound to emerge.

C. Safety-Critical Satellite-Based Communication and Surveillance Could Be Disrupted by Ligado Interference

The effects of Ligado transmissions on SATCOM must also be addressed. SATCOM is used as the primary means of Air Traffic Control communications and surveillance when flying in remote or oceanic areas and is currently provided by either INMARSAT or Iridium. These aircraft capabilities, called Controller-Pilot Data Link Communications (“CPDLC”) and Automatic Dependent Surveillance – Contract (“ADS-C”) are required to enter certain airspaces, including the heavily travelled North Atlantic oceanic airspace between Europe and North

²⁶ *E.g.*, as described in the Order ¶ 43, at 24.

America.²⁷ For the majority of these flights, there are availability requirements imposed²⁸ for both CPDLC and ADS-C of 0.999. FAA and other Air Navigation Service Providers require this performance to separate aircraft using CPDLC and ADS-C with a reduced separation standard at the target level of safety, compared to use of High Frequency voice.

It is not uncommon for a passenger to forget or refuse to place their phone into airplane mode during flights. If Ligado-compatible handsets were carried onboard aircraft by passengers and were to become active when SATCOM is being used for communications and surveillance, these safety services could potentially be disrupted. Loss of CPDLC and ADS-C would cause a large increase in pilot and Air Traffic Controller workload, as they scramble to implement backup voice communications and position reports using less reliable High Frequency radios, and would also result in aircraft separation to be in violation of standards until the Air Traffic Controller is able to apply larger separation between aircraft. FAA considers a large increase in Air Traffic Controller workload to be a “Major” hazard.²⁹ ALPA has been unable to determine the extent to which the Commission has evaluated this concern, because this situation was not addressed by the Commission in their discussion of the issuance of the license to Ligado.

The Order notes that Ligado has come to an agreement with INMARSAT,³⁰ where INMARSAT has agreed to modify their equipment specification to reduce the interference from Ligado transmissions on their satellite terminals (e.g., as equipment installed on aircraft). Ligado

²⁷ ICAO, *Implementation of Performance Based Separation Minima-Expanded Publication of PBCS OTS*, https://www.icao.int/EURNAT/EUR%20and%20NAT%20Documents/NAT%20Documents/NAT%20OPS%20Bulletins/NAT%20OPS%20Bulletin%202018_004.pdf (last visited May 14, 2020).

²⁸ FAA, Advisory Circular 90-117, *Data Link Communications* (Oct. 3, 2017).

²⁹ FAA Safety Manual, *supra* note 13, at 40.

³⁰ Order ¶ 63, at 36.

has not been able to come to agreement with Iridium. Iridium has submitted an analysis to the Commission docket indicating that with current equipment, a Ligado handset will likely cause widespread interference on Iridium satellite communications,³¹ even with the adjacent band requirements imposed on Ligado by the Commission.³²

Given the threat to existing equipment installed on aircraft, even if Ligado is able to come to agreement with both SATCOM providers on equipment modifications, there are still thousands of existing aircraft SATCOM installations in existence today worldwide.³³ In the near-term, these aircraft may be subject to hazardous interference caused by a Ligado handset. At a minimum, resolving this interference would likely result in the need for safety regulators around the world to mandate the wholesale of replacement of SATCOM equipment on aircraft without any plan for who will pay. Again, while the Commission says that it is possible to build SATCOM equipment robust enough to avoid interference from a Ligado transmitter, the Commission does not directly address the economic harm to owners and pilots of the thousands of aircraft with existing SATCOM equipment used in aviation.

³¹ Ex Parte Letter from Iridium Communications, Inc. (Oct. 2, 2019) (filed in IB Docket Nos. 11-109 and 12-340), <https://www.fcc.gov/ecfs/filing/100230214565>.

³² Order, ¶¶ 139-140, at 66-67.

³³ For example, data from ICAO estimates that there were approximately 10,000 aircraft flying in North Atlantic airspace alone. See ICAO, *NAT Traffic and Fleet Forecast* (June 2019), <https://www.icao.int/EURNAT/EUR%20and%20NAT%20Documents/NAT%20Documents/NA T%20Economics%20and%20Forecast/NAT%20Traffic%20Forecast%202018-2038%20-%202019%20-1.pdf>.

D. Reallocation of GPS Service Spectrum as directed by the Order raises Fundamental Public Policy Concerns that Should not have been Accomplished through Licensing Proceedings

The Ligado Order, if it stands, will result in precedent-setting reallocation of spectrum intended for satellite-only use in a way that is contrary to the national and public needs of current and future satellite service users. Such a precedent-setting result should have been, or should be, handled in an open or public policy proceeding with notice and opportunity for public comment that can more fully and properly consider the public harm and costs. As is obvious from the record in this proceeding many in the public believe this spectrum should be strongly protected.³⁴ The recent intense and widespread agency and industry opposition to the FCC's April 22, 2020 Order bears witness to the procedurally-tortured and now morphologically altered Ligado license applications.

The Commission's decision to reject the 1dB C/N₀ standard for harmful interference and to reallocate spectrum use for 5G terrestrial use in the manner stated in the Order presents fundamental issues that should properly be addressed through rulemaking, or at least an appropriate public policy proceeding. *See NTCH, Inc.*, 950 F.3d at 878-84 (considering whether Commission exceeded its authority under the Communications Act, 47 U.S.C § 316(a), by using license modification proceeding); 47 C.F.R. §§ 1.399 through 1.429 (FCC rulemaking proceedings).

³⁴ ALPA recognizes the Commission earlier found that fill-in terrestrial use for absent satellite signals at low power might be appropriate. The current Order has deviated from that concept based on perceived 5G network needs. We express no opinion here on potential and appropriate fill-in use for absent satellite signals at power levels significantly lower than those authorized in the Order.

CONCLUSION

Considering the evidence in the record and the risks, it is clear the Commission made a hasty, arbitrary, and incorrect decision that will set a disastrous precedent that will impede ongoing work on spectrum sharing. The Order degrades the safety of airline operations and puts passengers, crews and the safety of persons and property on the ground at additional risk in a way that the Commission did not even try to measure or quantify. Unlike license proceedings where the risk of “harmful interference” is largely monetary, *see, e.g., NTHC, Inc.*, 950 F.3d at 881, in these proceedings the real risk that should have been considered is safety of life. The vulnerabilities to our aviation safety and security are not worth the risk, particularly for a band of spectrum that is not necessary to secure a robust 5G network. For that and the reasons discussed above ALPA urges the Commission to reconsider, reverse its decision, and withdraw in its entirety its April 22, 2020 Order granting Ligado a license and authorizing the operation of terrestrial transmitters in the 1525-1559 MHz and 1626.5-1660.5 MHz bands.

Respectfully Submitted,



Capt. Bob Fox, First Vice President
Air Line Pilots Association, International
1625 Massachusetts Avenue, N.W.
Washington, D.C. 20036
(202) 797-4036

CERTIFICATE OF SERVICE

Pursuant to the Commission's Rules of Practice, I hereby certify that on this 20th day of May, 2020, I filed the foregoing Petition for Reconsideration of the Air Line Pilots Association, International, via the Commission's ECFS electronic filing system, and both mailed and email a copy of the Petition for Reconsideration to

Gerald J. Waldron
Covington & Burling LLP
One CityCenter
850 Tenth Street, NW
Washington, DC 20001-4956
gwaldron@cov.com.



Nadia McIlhany, Senior Paralegal
Legal Department
Air Line Pilots Association, International